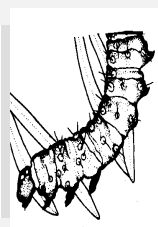
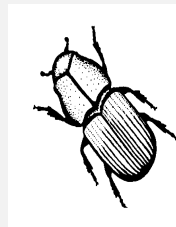


# Forest Health Protection



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## DOUGLAS-FIR BEETLE POPULATION SURVEYS IDAHO PANHANDLE NATIONAL FORESTS, 1998

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### INTRODUCTION

In November 1996, ice, heavy snows, and wind storms damaged and brought down large numbers of Douglas-fir trees. These downed and broken trees were infested in the spring of 1997 by Douglas-fir beetles (DFB). The downed material provided ideal conditions for a population build-up of this bark beetle, which then emerged in the spring of 1998 to infest standing trees. Large numbers of 1998 attacked trees (with beetle frass on the outside of the bark) were noticed during the summer by field personnel before tree crowns began to fade. Currently infested trees were not mapped during our regular aerial survey in late July and early August because their crowns were still green. However, some currently infested trees began to fade by September. A second aerial detection flight was conducted in late September covering only areas with known beetle populations which were of greatest concern to the Forest (about 20% of the IPNFs). Following the second aerial detection survey, we conducted ground surveys to determine the ratio of green infested trees to early fading trees. Because DFB often attacks trees fairly high on the bole (above 10 feet), success of DFB attack could not be determined with great accuracy from the ground. A sample of trees were felled (destructive sampling) to determine success of attack above where we could reach. In addition, a small number of trees at the Priest Lake Ranger District were sampled to determine the ratio of

DFB brood produced to attacking adults. This ratio gives us a better idea of whether a DFB population is building or declining. This report documents our findings.

### METHODS

#### *Group Sampling*

Polygons identified from aerial survey maps were visited on the ground. A total of 12 polygons with 1998 attacked trees were randomly identified and surveyed. We examined every attacked tree (those with beetle frass) within an attacked group and took the following information: presence or absence of pitch streamers, diameter at breast height (d.b.h), presence or absence of DFB galleries at breast height, degree of crown fade (red, yellow, green), position of fade within the crown (top, lower branches, mottled, or total crown), crown condition (thinning, broken top, etc.), and habitat type within the group.

#### *Destructive Sampling*

A total of 65 beetle attacked trees were felled and examined on the ground by Forest Health personnel and by Ladd Livingston, Idaho Dept. of Lands. The majority of trees examined were on the Coeur d'Alene River Ranger District and 15 were in the Joseph Plains area. Areas of bark along the bole were removed at various intervals to determine presence or absence of successful DFB galleries.

Galleries were determined to be successful if larval mines and brood were found. Intervals examined were 4.5 feet from ground level (breast height or BH), BH + 5 feet, BH + 10 feet, BH + 20 feet, BH + 30 feet, etc. until we no longer found galleries. Data recorded for each tree included presence of wood borers or other bark beetle galleries, d.b.h, a qualitative measurement of frass (high, moderate, or low) on the bole, and qualitative estimates of pitch and length of pitch streamers. Age was measured on 29 trees (rings counted).

#### *Priest Lake Brood Sampling*

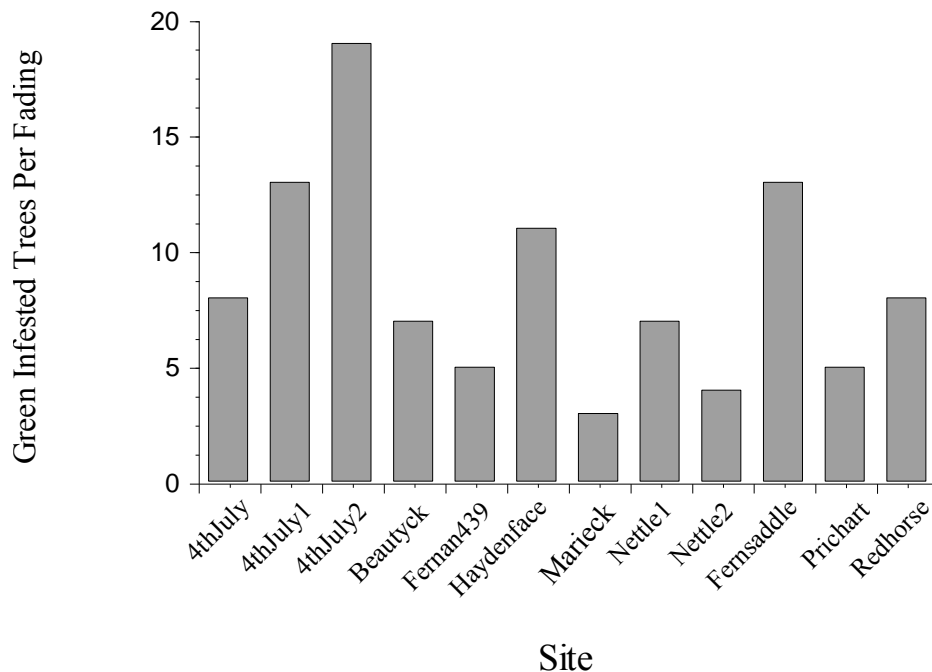
We examined three sites with DFB groups on the Priest Lake Ranger District in late August. Every attacked tree was recorded in each group and d.b.h measured. On trees with successful galleries at BH, we removed two 6-inch square pieces of bark from two sides of each tree. DFB gallery starts and all brood life stages (larvae, pupae, and new adults) were counted. Gallery starts were multiplied by two to estimate attacking parent beetles (a male and female for each gallery). Brood to parent ratios were then calculated. Any parasites or predators found were counted.

## **RESULTS**

### *Group Sampling*

The 12 groups examined ranged in size from 10 to 125 attacked trees. Small infested tree groups were located in mixed-species stands. Larger tree groups were in nearly pure Douglas-fir stands. The groups were located on the following habitat types: grand fir/ninebark, grand fir/queen cup beadleily, grand fir/wild ginger, cedar/queen cup beadleily, cedar/wild ginger, western hemlock/queen cup beadleily, and western hemlock/wild ginger (Cooper et al. 1991). Winter damage (broken or downed trees) was noted in or near all groups. A total of 566 attacked trees (those with boring dust or frass) were examined in the 12 groups. We found an average of 8 green infested trees for every yellow or red fading tree recorded by aerial survey (groups ranged from 3-19 green infested for every fading tree) (figure 1). An unusual fade pattern was observed on 88 trees (16%). These had a few red or yellow branches in the lower crown but the middle and top of the crowns were green. These trees were not recorded during aerial surveys. Average diameter of the attacked trees was 18.5 inches (range 8-36 inches). About 31% of the trees examined had successful DFB galleries at BH. Sixty-four percent of the attacked trees had pitch streamers on their boles, usually above 30 feet.

Figure 1. Number of green infested trees for every fading tree on 12 sites.

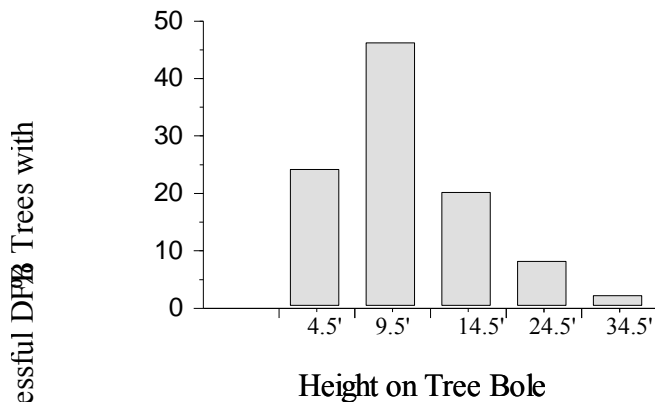


### Destructive Sampling

Of 65 trees cut for examination on the ground, 64 had frass on the bole and one had only pitch streamers to indicate beetle attack. The tree with only pitch streamers and no frass had no successful beetle galleries anywhere along the bole. Of the 64 with frass, 56 (88%) had successful DFB galleries somewhere on the bole. Of those trees, 24% had galleries at BH, 46% didn't have galleries below 9.5 feet above ground level, and 30% didn't have galleries below 14.5 feet or higher (figure 2). The presence of successful galleries indicates those trees would have died from beetle attack and subsequent spread of pathogenic fungi carried by the beetles. The average length along the bole containing successful galleries was 32 feet (range 10-70 feet). Flatheaded woodborer galleries were

found above and/or below DFB galleries in 32% of the trees. Another bark beetle, *Scolytus unispinosus*, was found in the tops of 7% of the trees, all of which were located in the Joseph Plains area. No other bark beetles were found. Average diameter of successfully attacked trees was 20.3 inches. Average diameter of trees unsuccessfully attacked was 16.5 inches. Of the successfully attacked trees, 60% had pitch streamers and 40% did not. Of the trees with unsuccessful attacks, 88% had pitch streamers and 12% did not. Height of pitch streamers varied from 11 to 70 feet along the bole from ground level. Unsuccessful DFB attacks were found under the bark in the area covered by pitch streamers. Average age of trees examined was 115 years (range 90-210).

Figure 2. Starting (bottom) height of successful DFB galleries on tree boles.



### Brood Sampling

The three infested groups examined at Priest Lake RD ranged in size from 10 to 32 attacked trees. A total of 55 trees were sampled. Beetle-attacked trees had an average diameter of 19.6 inches. Nineteen (34%) of these trees had successful galleries at BH. Brood to parent ratios from all three groups were greater than one (table 1). That is, there are more new beetles than old (parents) in our samples. The average for the three sites is 1.73. The average brood/parent ratio during an outbreak on the Clearwater NF from 1970-74 ranged from 0.8 to 2.5 (Furniss et al. 1979). Brood to parent ratios (sampled prior to overwintering) of less than 1 indicate a decreasing population (McGregor et al. 1975). Although overwintering mortality, mortality during flight and subsequent tree invasion has not been quantified for DFB, a 10% decrease has been assumed for each of the above three causes of mortality (Furniss et al. 1979). If we apply a 30% reduction to our sample to account for possible causes of mortality for the new generation, we get an average brood/parent ratio of 1.2. Since DFB galleries are not as consistent at BH as they are higher on the bole, our population estimates are probably conservative. Sampling higher may have revealed a greater brood/parent ratio where attacks are more uniform

and representative of infestation in the tree (Furniss et al. 1979). Occurrence of parasites and predators was low in our samples. We found larvae of the parasitic fly, *Medetera* spp., cocoons of the parasitic wasp, *Coeloides vancouverensis*, and larvae of predatory clerid beetles. However, only one parasite or predator was found for every 21 DFB larvae, pupae, or new adult.

Table 1. Brood to parent ratios at three sites on the Priest Lake RD.

Site	Brood/parent ratio
Rocky Vista	1.7
Snow la Tob	2.4
Snick's Toe	1.1

### CONCLUSIONS

The results of our surveys indicate that Douglas-fir beetle caused tree mortality is much greater than what is currently shown on aerial survey maps. Almost 90% of trees attacked in 1998 still had green crowns in October and November. Attacked trees won't be readily apparent until their crowns start fading which may not occur until the summer of 1999. The full extent of 1998 tree mortality will be better defined after aerial surveys are conducted in July and August 1999. DFBs are killing fairly large trees (greater than 18 inches in diameter) and trees greater than 100 years old. The majority of

groups we sampled occurred on moist habitat types (hemlock, cedar, and grand fir).

Our destructive sampling shows that 88% of trees attacked in 1998 contain successful beetle galleries and will die. We found 12% of attacked trees had unsuccessful beetle galleries which is less than what was reported during an outbreak that occurred on the Clearwater National Forest from 1970-74 (Furniss et al. 1979). During that outbreak, unsuccessful attacks ranged from 22% to 58% during the 4 years data was collected from 1971-74 (4-year average 42%). However, they were not able to examine beetle populations during the first year of the outbreak in standing trees as we did here. It is likely that the number of unsuccessfully attacked trees will increase during subsequent years of the current outbreak as beetle numbers decline. Also, they determined success of attack from the ground and may have overestimated the number of unsuccessful attacks as indicated when trees were re-sampled from ladders at heights of 10 to 12 feet (Furniss et al. 1979).

The combination of large numbers of successfully attacked trees and brood to parent beetle ratios

greater than one, is evidence that the DFB population is not yet declining. High populations are expected to emerge in the spring of 1999 to attack additional trees.

## REFERENCES

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